REMARKS

Claims 1 through 19 remain in the application.

35 U.S.C. § 103

Claims 1 through 19 were rejected under 35 U.S.C. § 103 as being unpatentable over Kanai et al. "A Virtual Verification Environment for the Sequence Control System Using VRML and JAVA", 1999 by ASME, pgs. 1 through 8 in view of Rohrer "Automod Product Suite Tutorial", Proceeding of the 1999 Winter Simulation Conference, pgs. 220-226. Applicants respectfully traverse this rejection.

As to patentability, 35 U.S.C. § 103 provides that a patent may not be obtained:

> If the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Id.

The United States Supreme Court interpreted the standard for 35 U.S.C. § 103 in Graham v. John Deere, 383 U.S. 1, 148 U.S.P.Q. 459 (1966). In Graham, the Court stated that under 35 U.S.C. § 103:

> The scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background, the obviousness or non-obviousness of the subject matter is determined. 148 U.S.P.Q. at 467.

Kanai et al. discloses a virtual verification environment for a sequence control system using VRML and JAVA. Sequence control is one of the key components of realizing the various kind of current automated factory equipment. Building the system components in the equipment and programming the control code in a PLC are two major activities in developing the

sequence control system. VRML2.0 was originally designed as the standard specification language of 3-D geometry and its dynamic behaviors. It can be executed on any platform and any operating system. There are many VRML viewers and authoring tools commercially available, and they are much less expensive than the commercial discrete-event simulators. The specification of VRML includes the behavioral mechanism of the scene based on the event cascade. The execution engine is also installed in all VRML viewers. The language format is specified as the ISO/IEC international standard. The language can be executed in any operating system, and can be easily imported through networks. Generally, the sequence control system can be modeled as a set of finite state machines. State variables, input variables, and output variables of each component model can be defined as fields in the prototype node of the VRML. The state transitions of each model can be also described in the script nodes by combining the external JAVA code with the VRML. 3-D geometry of the components, their motion behaviors corresponding to the state transition of the component can be easily defined by adding the several standard nodes of VRML in the code. Inexpensive VRML viewer can be used for the visual verification of the co-simulation. As a result of co-simulation, the model of components in the VRML viewer (Community-Place Browser) can be dynamically moved according to the control code in the PLC. Kanai et al. does not disclose the steps of generating transformational arrays for a mechanical model by incrementally recording one position of each piece of geometry of the mechanical model moved through space over a period of time using a computer and viewing motion of the mechanical model in a motion viewer based on the transformation arrays using the computer. Kanai et al. also does not disclose the steps of using the accepted motion of the mechanical model to compare the behavior of the PLC code relative to the accepted motion by playing the PLC code with a PLC emulator.

Rohrer discloses an automod product suite tutorial. Under user interaction, Automod provides advanced debugging and trace facilities. A model can be single-stepped at any time during the animation. Vehicle states are tracked during the entire model run, and reports are generated automatically. Rohrer does <u>not</u> disclose the steps of generating transformational arrays for a mechanical model by incrementally recording one position of each piece of geometry of the mechanical model moved through space over a period of time using a computer and viewing motion of the mechanical model in a motion viewer based on the transformation arrays using the computer. Rohrer also does <u>not</u> disclose the steps of using the accepted motion of the mechanical model to compare the behavior of the PLC code relative to the accepted motion by playing the PLC code with a PLC emulator.

In contradistinction, independent claim 1 claims the present invention as a method of emulating machine tool behavior for a programmable logic controller logical verification system for manufacturing a motor vehicle. The method includes the steps of constructing a mechanical model using a computer, generating transformational arrays for the mechanical model by incrementally recording one position of each piece of geometry of the mechanical model moved through space over a period of time using the computer, viewing motion of the mechanical model in a motion viewer based on the transformation arrays using the computer, and determining whether the motion of the mechanical model is acceptable. The method also includes the steps of replicating the motion of the mechanical model by generating a PLC code for the motion of the mechanical model using the computer if the motion of the mechanical model was acceptable and using the accepted motion of the mechanical model to compare the behavior of the PLC code relative to the accepted motion by playing the PLC code with a PLC emulator. Independent claim 11 is similar to claim 1 and includes other features of the present invention.

The United States Court of Appeals for the Federal Circuit (CAFC) has stated in determining the propriety of a rejection under 35 U.S.C. § 103, it is well settled that the obviousness of an invention cannot be established by combining the teachings of the prior art absent some teaching, suggestion or incentive supporting the combination. See In re Fine, 837 F.2d 1071, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988); Ashland Oil, Inc. v. Delta Resins & Refractories, Inc., 776 F.2d 281, 227 U.S.P.Q. 657 (Fed. Cir. 1985); ACS Hospital Systems, Inc. v. Montefiore Hospital, 732 F.2d 1572, 221 U.S.P.Q. 929 (Fed. Cir. 1984). The law followed by our court of review and the Board of Patent Appeals and Interferences is that "[a] prima facie case of obviousness is established when the teachings from the prior art itself would appear to have suggested the claimed subject matter to a person of ordinary skill in the art." In re Rinehart, 531 F.2d 1048, 1051, 189 U.S.P.Q. 143, 147 (C.C.P.A. 1976). See also In re Lalu, 747 F.2d 703, 705, 223 U.S.P.Q. 1257, 1258 (Fed. Cir. 1984) ("In determining whether a case of prima facie obviousness exists, it is necessary to ascertain whether the prior art teachings would appear to be sufficient to one of ordinary skill in the art to suggest making the claimed substitution or other modification.")

As to the differences between the prior art and the claims at issue, Kanai et al. merely discloses a virtual verification environment for a sequence control system using VRML and JAVA in which the sequence control system can be modeled as a set of finite state machines and state variables, input variables, and output variables. Kanai et al. lacks the steps of generating transformational arrays for a mechanical model by incrementally recording one position of each piece of geometry of the mechanical model moved through space over a period of time using a computer and viewing motion of the mechanical model in a motion viewer based on the transformation arrays using the computer to determine whether the motion of the mechanical model is acceptable. In Kanai et al., during, co-simulation, there is a series of

snapshots on the VRML viewer, however, there are no transformational arrays for the mechanical model that are generated by incrementally recording one position of each piece of geometry of the mechanical model moved through space over a period of time prior to the co-simulation on the VRML viewer to determine if the motion of the mechanical model is acceptable. The snapshots and transformational arrays are not analogous and the Examiner has misinterpreted the Kanai et al. reference.

Kanai et al. also lacks the steps of using the accepted motion of the mechanical model to compare the behavior of the PLC code relative to the accepted motion by playing the PLC code with a PLC emulator. In Kanai et al., there is no PLC emulator to play the PLC code such that the user can observe the motion of the mechanical model using the actual PLC code as if they were watching a machine or manufacturing line of a vehicle assembly plant floor as claimed by Applicants.

Rohrer merely discloses an automod product suite tutorial in which vehicle states are tracked during the entire model run and reports are generated automatically. Rohrer lacks generating transformational arrays for a mechanical model by incrementally recording one position of each piece of geometry of the mechanical model moved through space over a period of time using a computer and viewing motion of the mechanical model in a motion viewer based on the transformation arrays using the computer. Rohrer also lacks using the accepted motion of the mechanical model to compare the behavior of the PLC code relative to the accepted motion by playing the PLC code with a PLC emulator. As such, there is no suggestion or motivation in the art to combine Kanai et al. and Rohrer together.

As to the level of ordinary skill in the pertinent art, in Kanai et al., during, co-simulation, there is a series of snapshots on the VRML viewer, however, there are no transformational arrays for the mechanical model that are generated by incrementally recording

one position of each piece of geometry of the mechanical model moved through space over a period of time prior to the co-simulation on the VRML viewer to determine if the motion of the mechanical model is acceptable. In Rohrer, vehicle states are tracked during the entire model run and do not allow for transformational arrays for the mechanical model that are generated. Also, neither reference teaches generating CAD transformational arrays. Further, neither reference allows for a PLC emulator to play the PLC code such that the user can observe the motion of the mechanical model using the actual PLC code as if they were watching a machine or manufacturing line of a vehicle assembly plant floor. As such, there is absolutely no teaching of a level of skill in the programmable logic controller art that a method of emulating machine tool behavior for a programmable logic controller logical verification system for manufacturing a motor vehicle includes the steps of generating transformational arrays for a mechanical model by incrementally recording one position of each piece of geometry of the mechanical model moved through space over a period of time using a computer, viewing motion of the mechanical model in a motion viewer based on the transformation arrays using the computer, and using the accepted motion of the mechanical model to compare the behavior of the PLC code relative to the accepted motion by playing the PLC code with a PLC emulator. The Examiner may not, because he/she doubts that the invention is patentable, resort to speculation, unfounded assumptions or hindsight reconstruction to supply deficiencies in the factual basis. See In re Warner, 379 F. 2d 1011, 154 U.S.P.Q. 173 (C.C.P.A. 1967).

The present invention sets forth a unique and non-obvious combination of a method of emulating machine tool behavior for a programmable logic controller logical verification system for manufacturing a motor vehicle that allows a controls engineer to compare the behavior of the PLC code to accepted motion of a CAD model as part of PLC logical verification system and uses transformational arrays that allows a different software technology

to do the rendering, one that requires much less computer resource per unit of machine, and allows a controls engineer to examine the visual behavior of an entire manufacturing line, thereby verifying some of the more difficult controls problems such as inter-workcell behavior through observation of the visual operation of multiple concurrent workcells. In this instance, the Examiner has adduced no factual basis to support his/her position that it would have been obvious to one of ordinary skill in the art to combine the teachings of Rohrer with Kanai et al. because both references are concerned with manufacturing and material handling and it would have been convenient to track the vehicle (i.e. mechanical model) movement during the entire run, as taught by Rohrer, to the system of Kanai et al. to observe motion sequence and signal change and verify the effectiveness of the proposed modeling and implementation method. The Examiner's stated conclusion of obviousness is based on speculation, unfounded assumptions or hindsight reconstruction to supply deficiencies in the factual basis.

The references, if combinable, fail to teach or suggest the combination of a method of emulating machine tool behavior for a programmable logic controller logical verification system for manufacturing a motor vehicle including the steps of constructing a mechanical model using a computer, generating transformational arrays for a mechanical model by incrementally recording one position of each piece of geometry of the mechanical model moved through space over a period of time using the computer, viewing motion of the mechanical model in a motion viewer based on the transformation arrays using the computer, determining whether the motion of the mechanical model is acceptable, replicating the motion of the mechanical model by generating a PLC code for the motion of the mechanical model using the computer if the motion of the mechanical model was acceptable, and using the accepted motion of the mechanical model to compare the behavior of the PLC code relative to the accepted motion by playing the PLC code with a PLC emulator as claimed by Applicants.

Further, the CAFC has held that "[t]he mere fact that prior art could be so modified would not have made the modification obvious unless the prior art suggested the desirability of the modification". In re Gordon, 733 F.2d 900, 902, 221 U.S.P.Q. 1125, 1127 (Fed. Cir. 1984). The Examiner has failed to show how the prior art suggested the desirability of modification to achieve Applicants' invention. Thus, the Examiner has failed to establish a case of prima facie obviousness. Therefore, it is respectfully submitted that claims 1 through 19 are allowable over the rejection under 35 U.S.C. § 103.

Obviousness under § 103 is a legal conclusion based on factual evidence (In re Fine, 837 F.2d 1071, 1073, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988), and the subjective opinion of the Examiner as to what is or is not obvious, without evidence in support thereof, does not suffice. Since the Examiner has not provided a sufficient factual basis, which is supportive of his/her position (see In re Warner, 379 F.2d 1011, 1017, 154 U.S.P.Q. 173, 178 (C.C.P.A. 1967), cert. denied, 389 U.S. 1057 (1968)), the rejection of claims 1 through 19 is improper. Therefore, it is respectfully submitted that claims 1 through 19 are allowable over the rejection under 35 U.S.C. § 103.

Based on the above, it is respectfully submitted that the claims are in a condition for allowance or in better form for appeal. Applicants respectfully request reconsideration of the claims and withdrawal of the final rejection. It is respectfully requested that this Amendment be entered under 37 C.F.R. 1.116.

Respectfully submitted,

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